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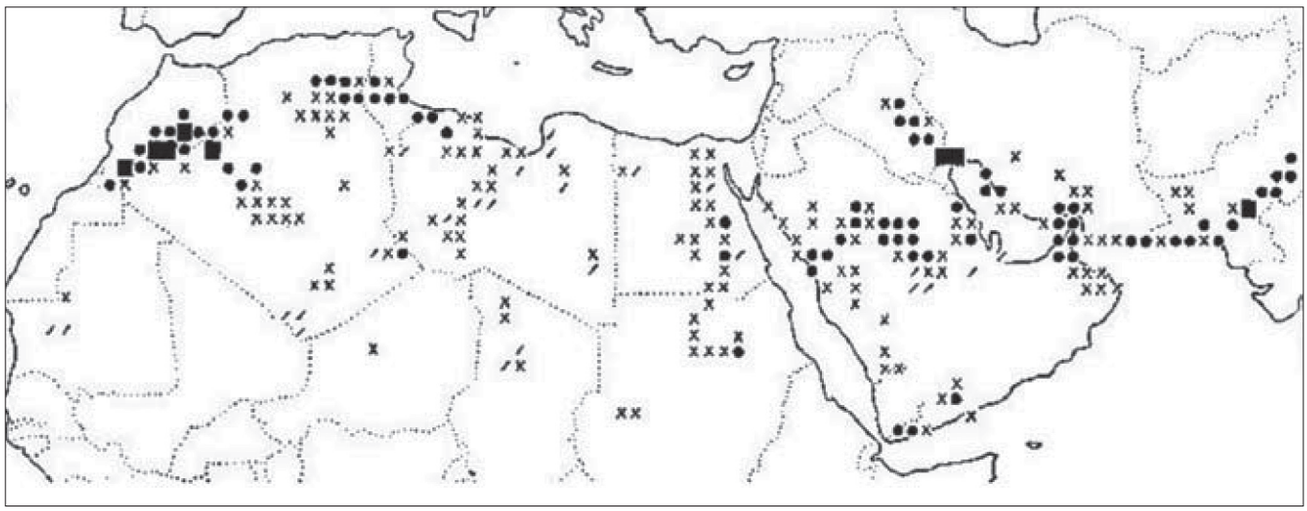
The Date Palm and its Role in Reducing Soil Salinity and Global Warming

Abstract

The date palm is a blessed tree that is known for its various benefits. It plays a big role in achieving environmental balance, as it grows in a harsh climatic environment and even in highly saline sand. Moreover, the date palm absorbs carbon dioxide to a significantly greater extent than other trees, due to its large size. It also on average stores more carbon than other trees of similar size. This potential makes the date palm an important tool in the fight to stave off global warming, which is mainly caused by carbon dioxide emissions. Consequently, this paper proposes a massive date palm tree

Figure 1. Distribution of Date Palm plantations in the mid-1960s [1]



planting exercise in the Arab world, in order to make it the world's future lungs that would transform carbon dioxide into oxygen and food, in a similar way to the Amazon's rainforest. The paper makes a number of recommendations, including the need for taking good care of this neglected tree, the provision of government incentives for growing it, and the inclusion of the planting of date palms as part of carbon offset projects which would be incorporated into an overall sustainable development agenda.

Keywords: Date palm, dates, Phoenix dactylifera, Iraq, global warming.

Introduction

Date palm (scientific name Phoenix dactylifera) plantations exist in several regions of the world, but they are particularly concentrated in the MENA region (Figure 1). The date palm is one of the most prominent trees in the Arab world in general, and in Iraq in particular where it is considered to be the national tree that is distinguished globally. The date palm has played a very important role in the economic, social and religious aspects of life for generations because it was one of the most vital sources of food for date palm cultivators. Estimates indicated that in Iraq there were 30 million date palm trees in 1970. The scars of war and economic crises were among the most significant reasons for the deterioration of the date palm industry in Iraq. During the first Gulf War (1980-1988) and the second (1991), more than 20 million palm trees were completely destroyed in Iraq. It is estimated that there are 350-400 date types, including high quality dates. Notably, the date was considered to be Iraq's second largest national export after oil. According to a report by the United Nations Food and Agriculture Organization (FAO) Iraq was – before the embargo – the largest date producer, producing 550 thousand tones per annum. This is equivalent to 80% of the world market and generated an annual revenue of nearly 50 million dollars for Iraq. However, the situation has changed greatly; Iran, Egypt and Saudi Arabia exceeded Iraq in terms of exportation, to the extent that Iraq's export figures no longer appear officially at the international level. By contrast, Tunisia occupied first place in terms of world's date exports with an annual income equal to 47 million dollars followed by Pakistan with 23 million dollars and Iran with 21 million dollars.

The FAO reports have confirmed that the United Arab Emirates has stepped

Low salt tolerance	Medium salt tolerance	High salt tolerance
Pear Almond	Pomegranate	Date Palm
Apple Apricot	Fig	
Orange Peach	Olive	
Grapefruit Strawberry	Grape	
Prune Lemon	Cantaloupe	
Plum Avocado		

up its date exports by a factor of four times between 1989 and 1993. However, dates exports rose even higher in Iran, from 10 thousand tonnes in 1989 to 60 thousand tonnes in 1993 [2]. In 1994, Iraq's date palm productivity was around 20-25 Kilos for one date palm, whereas, in same year, date palm productivity reached 60-70 kilos in Saudi Arabia [3].

Reasons behind the Decline of the Date Palm

There has been a major decline in interest in date palms since the 1960s and this negligence had doubled by the 1980s. Several reasons have been attributed to this decline in palm tree cultivation. These include:

1- Urban sprawl.

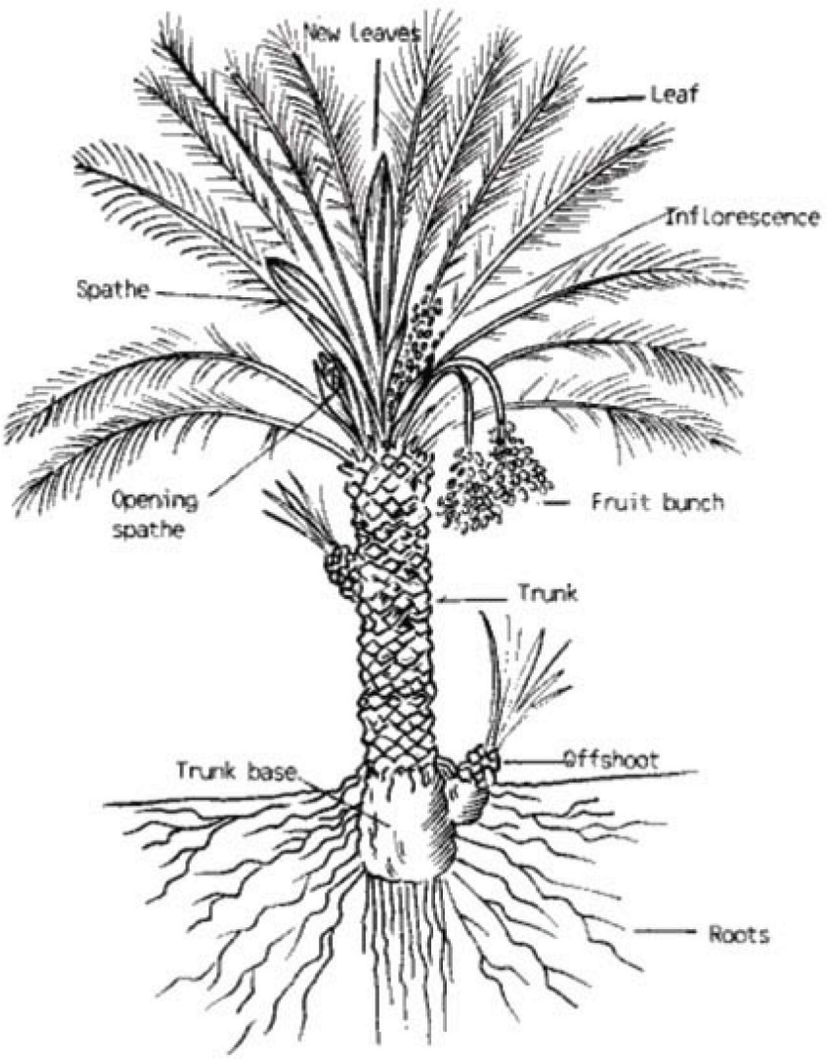
2- Lack of government interest and lack of serious plans for date palm plantations.

3- Negligence of farmers and failure to use technology for date palm cultivation.

4- Shortage of water and high soil salinity.

5- Effects of war upon the agriculture sector and the economic blockade which accelerated the depletion process of date palms in Iraq. This depletion began with the first Gulf War and has continued until the present day, however only recently a change of the trend is observed and Iraq starts planting more date palms [8].

Figure 2. Schematic Illustration of Date Palm Tree and its Parts [3]



Characteristics of the Date Palm

The date palm is a unique type of palm tree. This is because it is deciduous and wind pollinated. There are nearly 500 types of date palms. The date palm is tall and can grow to a height of 24-30 meters. They can live for more than 200 years. Date palm leaves are beautiful and they normally do not fall off until the tree dies. Date palms can grow in hot arid regions, with temperatures ranging between 24 and 34 oC. They adapt well to a harsh climatic environment, even with water scarcity and excessively high temperatures. However, it is sometimes argued that it would be best to grow date palms in areas which are characterized by long and hot summers (during which dates mature), with winter temperatures not less than -90C. Such climates exist in the Arabian Peninsula, Iraq and the South-West region of Iran, where high quality dates mature perfectly while on the tree.

Moreover, date palm can grow in different types of soil, including dry, clay and sandy soils. The table below, which demonstrates the salt tolerance for different types of plants, shows that the date palm is best adapted to a high salt tolerance environment (i.e. 2000 – 500 ppm). Recent studies even indicate that the range is, in fact, 6000 – 7000 ppm [4]. It should be noted however that, depending

upon the environment and the type of soil, the productivity of the date palm decreases as the salt concentration increases.

It is commonly known that photosynthesis refers to the process that converts carbon dioxide into organic compounds such as sugars (i.e. glucose) using the energy from sunlight. Date palms absorb carbon dioxide (CO_2) and produce sugar, oxygen (O_2) and water (H_2O), similar to other plants, as shown in the following formula:

6- $CO_2(g) + 12\ H_2O(l) + \text{photons} \rightarrow C_6H_{12}O_6(aq) + 6\ O_2(g) + 6\ H_2O(l)$

Based on this formula, 1.46 tonne of CO_2 and 1.2 tonne of water can produce one tonne of sugar, 0.53 tonne of oxygen and 0.6 tonne of water. This translates to the net use of only 0.58 tonnes of water. The sugar produced forms a main source of food for humans and animals, both of which are the main polluters of the environment. Indeed, the amount of absorbed CO_2 depends on the size of the plants' green parts. Here, it is perhaps worth acknowledging that the date palm is a large tree with very dense leaves (the length of a leaf is 4-5 metre), and each leaf has approximately 150 leaflets (each leaflet is around 30 centimetres in length and 2 centimetres in width). Moreover, given that the height of the date palm tree ranges from 15 to 25 metres, its absorption of CO_2 is significant. Figure 2 illustrates the parts of the date palm tree.

Moreover, carbon constitutes 50% of the dry wood, whilst water represents around 75% of the whole living plant. With regard to the date palm, water constitutes a maximum of 25%, whilst carbon makes around 60% (all of which has been absorbed from the tmosphere). It should be noted that although the amount of captured

carbon depends on the type and age of the tree, carbon is also stored in the trunk and roots. It is common knowledge that burning one tonne of carbon produces 3.66 tones of CO_2 as per the following reaction:

$C + O_2 = CO_2$

In other words, the production of one tone of carbon requires around 3.66 tone of CO_2. Given that not only is the date palm a long living tree (with an age that might exceed 100 years), and is also a large tree with the biggest roots (with wood density of around 200-900 kg/m3 [5]), comparatively significant amounts of CO_2 are absorbed and stored in the trunk and roots of the tree in a form of carbon. Assuming a height of 15 meters and a diameter of 0.5 meters, the mass of the trunk woods is approximately 1,472 kg. Thus, water constitutes: 1,472 x %25 = 368 kg.

The remaining solid part would represent 1,472 – 368 = 1,103.8 kg.

The carbon mass would be around 1,103.8 x %50 = 552 kg.

This would lead to a total lifetime amount of carbon dioxide of around: 522 x 3.66 = 2020.3 kg of CO_2.

Another distinctive feature of the date palm is its productivity. It is estimated that during the first 5 to 8 years of its life, the yearly corps is around 8-10 kg. The total crop, up to 13 years of age, is around 60-80 kg. When the date palm is grown in a suitable agricultural and climatic environment, with proper care, its crop could reach 100 kg per year [6]. About 79% of that weight is carbohydrate which is a form of carbon. This would mean that a mature date palm, in addition, to storing large amount of carbon in its trunk and roots, it coverts a large amount of CO_2 which is annually equivalent to about 290 kg, as well as producing food.

Date Palm: Environmental and Economic Implications

Like all plants, the date palm has a positive impact on the environment, not to mention its aesthetic advantage in decorating roads and improving the landscape. It provides shade and comfort to human life. According to recent studies, the date palm has the potential for improving the environment of the Arab world through the following:

1) Given the adaption features of the date palm, it has an important role in enhancing ecological balance and reducing desertification. The intensification in the growing of date palms near cities could work as a shield against dust storms.

2) Palm trees have a big potential in absorbing CO_2 from the atmosphere; something that is of high priority to a wide range of governmental and non-governmental organizations. Compared to other plants of a comparable size, the palm tree needs a minimal amount of water. In an earlier study [7], it was demonstrated that one million mature date palm trees can absorb 2.0 million tones of CO_2. Based on photosynthesis calculations, we can suggest that since one date palm tree would lead to a reduction of CO_2 by 200 kg annually, growing a million trees would absorb 200,000 tones of CO_2 as well as the food value.

3) Besides its high CO_2 absorption potential, date palms have a high storage capability given its large size and long life.

4) Given that the annual crop of dates from a single date palm could exceeds 100 kg [6], growing date palms on a large scale could generate both high revenue and jobs.

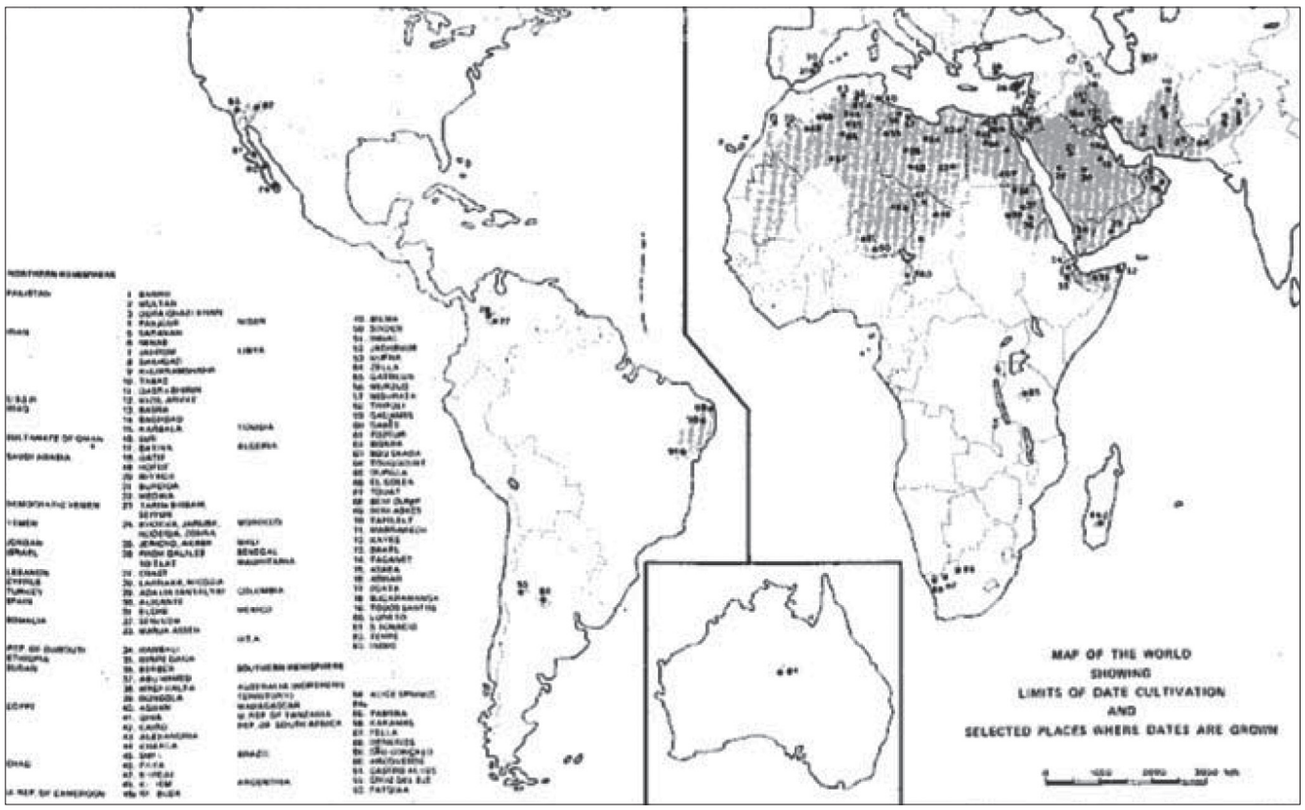
5) Within date palm farms, there tend to be large spaces between palms. These could be used to grow different types of fruits such as grapes (which also have a high carbon content and nutritious value).

Iraq as the World's Future Lungs

Considering the CO_2 emissions in England – for instance – it has been estimated that it produced 566.7 million tones of CO_2 in 2007. This makes the country among the highest CO_2 producers in the world (bearing in mind that the United States of America produces 5,877 million tones). Growing 100 million palm trees could absorb up to 200 million tones of CO_2 (i.e., the equivalent of 30% of England's total emissions). Growing this number of date palms would require 3,600 km2 (i.e. around 1.5% of England's land area), assuming that one km2 would be enough to grow 30,000 date palms. It should also be noted that not all of these date palms need to be grown on a single farm. However, given that the climatic environment of England is not suitable for growing date palms; other counties – with more suitable environments, such as Iraq or other MENA countries – could contribute in such an endeavor.

In this regard, it is proposed to intensify date palm cultivation in Iraq, which once had at least 30 million palm trees. Figure 3 shows that Iraq, among a number of other Arab countries, leads the world in terms of date crops. This would essentially make Iraq the world's future lungs that would enable it to inhale CO_2 and exhale oxygen, in a similar way to the Amazon rainforest, as well as producing high value and quality food. If the target of 30 million palm trees is achieved, it is possible that 6 million tones of CO_2 would be absorbed annually, not to mention approximately 60.0 million tones of carbon that would be stored in the trunk and roots, during the life time of the trees.

Figure 3: International Spread of Date Cultivation [4]



Moreover, it should be remembered that Iraqi dates are among the highest quality and rarest type in the world. This means that growing date palms in Iraq is likely to generate high economic returns, whilst providing employment opportunities. There is no doubt, given the magnitude of such an ambitious project, that Iraq would require regional and international support in terms of the planning, funding and scientific aspects. It is worth acknowledging here that, as a result of the support provided by the United States Agency for International Development (USAID), interest in growing date palms has been revived to the extent that 410,000 date palms have been planted per annum, in different parts of Iraq since 2003 [8].

Date Palms and Sustainable Development

Given the recent environmental concerns, there have been many calls for providing solutions that would ultimately lead to sustainable development. The most cited definition of sustainable development is perhaps the one provided by the World Commission on Environment and Development in 1987: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [9]. The world, as a whole, is trying to find a compromise between economic growth and preserving natural resources, whilst taking into account the economic, environmental

and social aspects of sustainable development. One of the most sustainable ways of achieving this is land cultivation and the greening of the earth. In this regard, it is argued that the date palm has a strong potential for achieving sustainable development through providing shade, achieving an ecological balance, producing food and improving the air quality. Therefore, it is of strategic importance to intensify the growing of date palms. It is also worth mentioning here that 'carbon offset projects', which are gaining momentum around the world, could be used to encourage the cultivation of palm trees. Carbon offsetting, which refers to the idea of assuaging guilty consciences as a result of the production of greenhouse gases (including CO_2), offers a range of ways for individuals and businesses to participate in global warming solutions. The basic idea is to figure out the 'carbon footprint', which refers to the individual's contribution to the global warming problem, and then attempt to balance out this footprint through buying carbon offsets which could be used for a wide range of environmentally-friendly projects such as the development of renewable energy and tree planting projects. It is proposed here to place date palms at the top of the tree planting initiatives in Iraq (and the Arab world in general), as part of the carbon offsetting endeavours. This would help in realising the ambition of making Iraq the future lungs of the world by inhaling CO_2 and exhaling oxygen.

Conclusions

Date palms have a strong potential in addressing the problem of global warming, along with tackling air pollution and soil salinity problems. Plans must be put into place in order to effectively utilize date palms and make them the future lungs of the world. Awareness of the benefits of date palms has to be raised among decision makers, investors and the general public. There is a need to organize conferences and seminars that explain the potentially important role of date palms. Moreover, funds need to be allocated to support research projects aimed at improving the cultivation of date palms. Last, but certainly not least, growing date palms needs to be incorporated into sustainable development initiatives and carbon offset projects.

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